

Gold Mining as key to Eastern Beringia - Impressions from the AWI Expedition 2023 to the Klondike Goldfields

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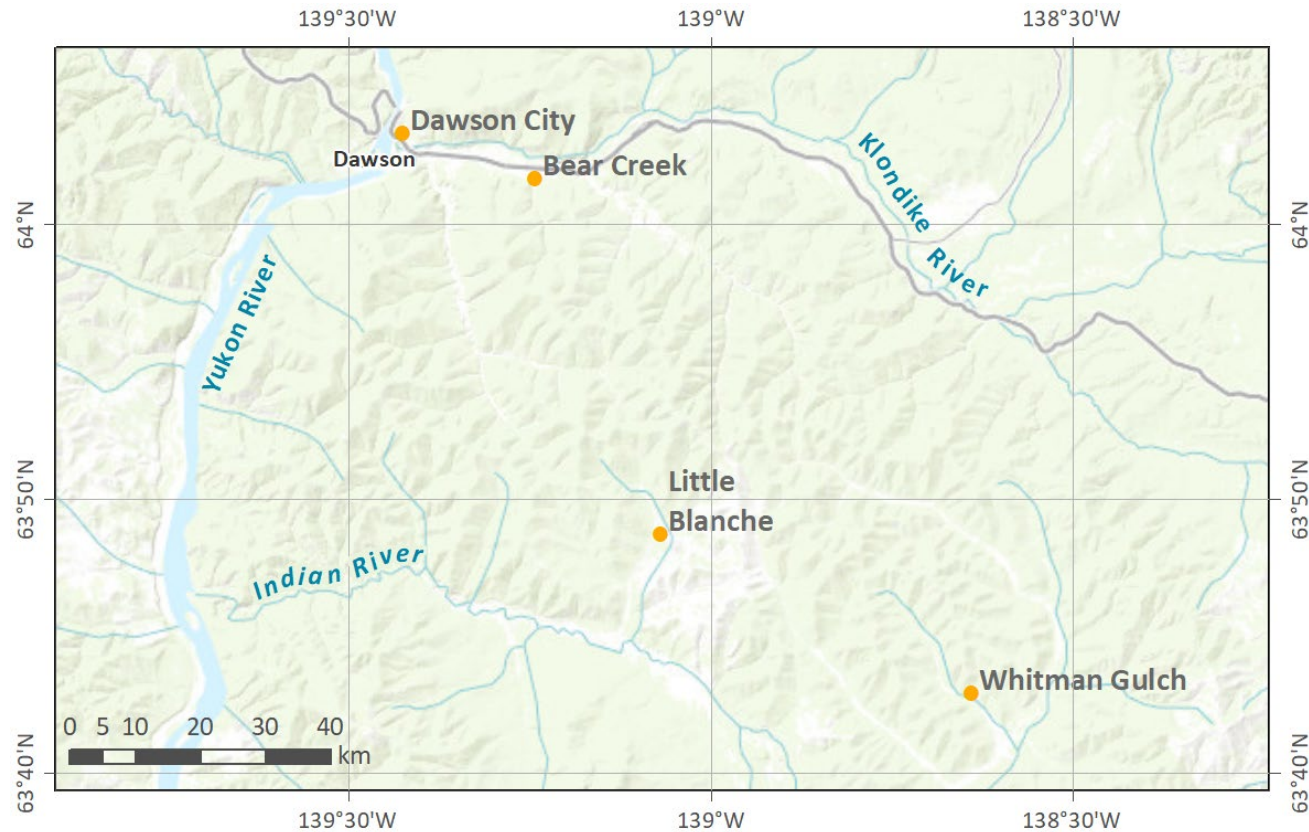
During the expedition CA-Land_2023_Klondike in summer 2023, three colleagues from Potsdam worked together with Trevor Porter and Mickey Cheng from the University of Toronto on permafrost outcrops in the Klondike Goldfields (Canada) near Dawson City.

Study area of the Klondike Goldfields



This is the easternmost area of the late Pleistocene Yedoma Ice Complex

The Klondike Goldfields, with the largest settlement Dawson City, are located in western Canada in the Yukon Territory near the Alaskan border at the mouth of the Klondike River into the Yukon River and is known for its gold mining since the end of the 19th century.

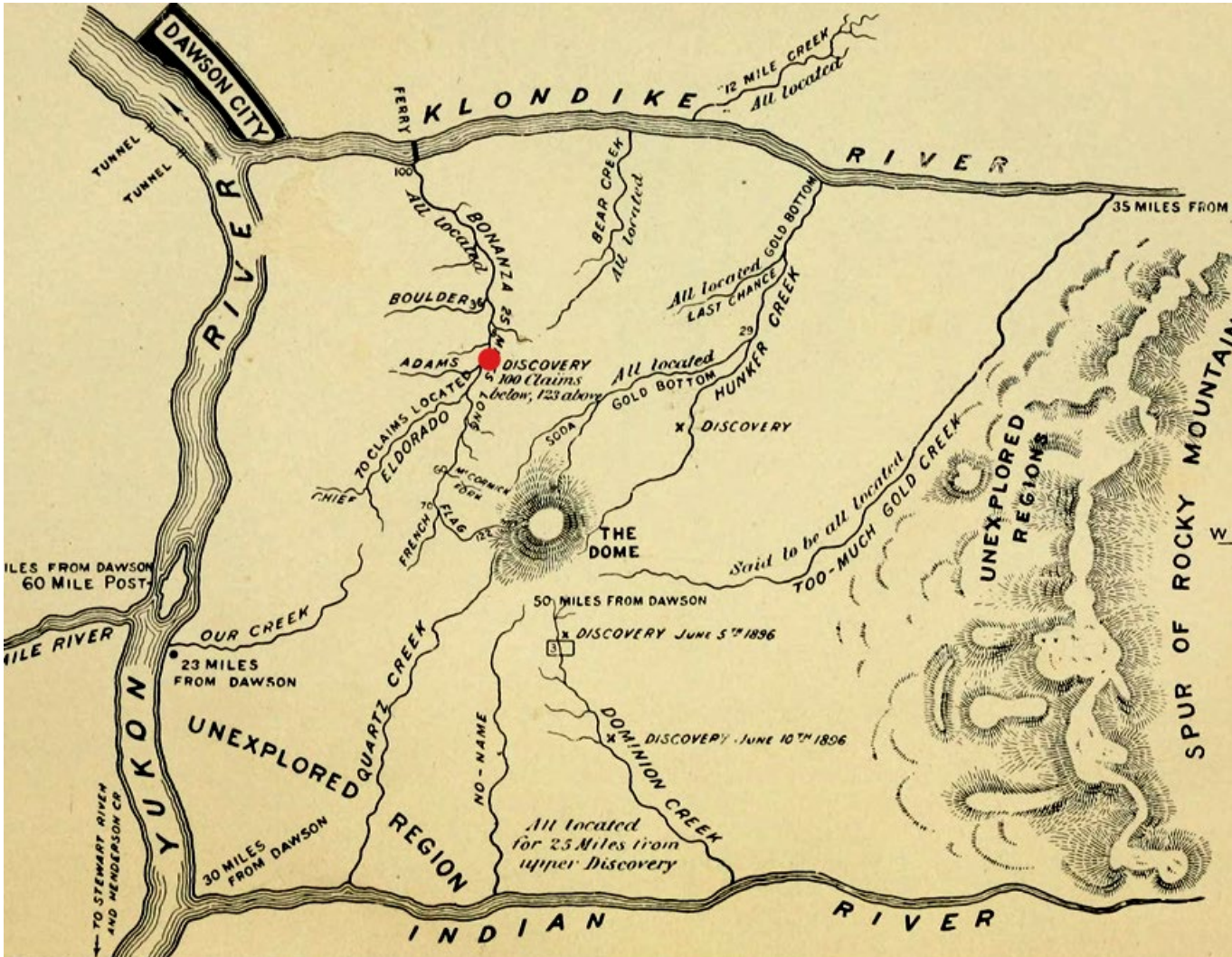


Gold mining at the end of the 19th century

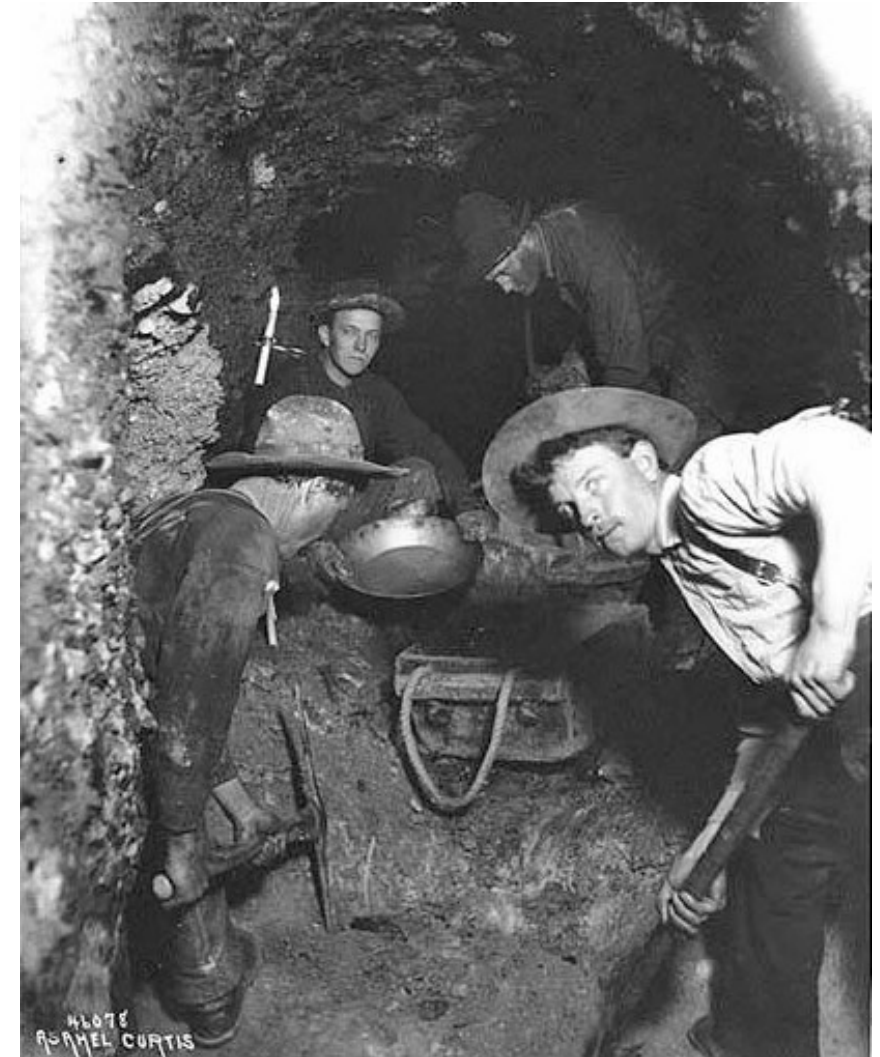
The Klondike Gold Rush was the migration of around 100 000 prospectors to the Klondike region between 1896 and 1899.

-> Gold panning in rivers and creeks -> Setting fires in shafts to thaw the permafrost and to reach the gold-bearing gravels

-> Construction of water pipes to wash out the gold



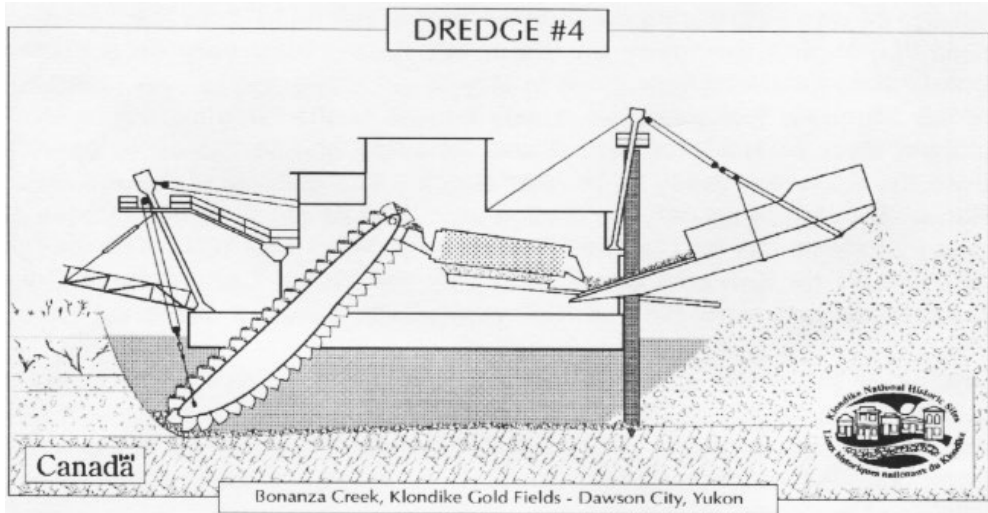
Map of goldfields with Dawson City and Klondike River at top



Mining in a shaft, 1898

Gold mining - Gold dredging

More than twenty dredges operated in the Klondike Goldfields with the first built in 1899. They operated until the 1960s.



Dredge No 4 a national historic site

Pav Ron Dredge

Landscape after gold dredging



Gold mining - Quarrying the gold-bearing gravels



Hydraulic mining techniques (Withman Gulch mine)

Different sizes of opencast mines. From two people working there to huge opencast mining areas.

Numerous heavy excavators and vehicles (Paradise Hill mine)



Main objectives of the Klondike expedition 2023

- Improve the existing stratigraphy and chronology using different dating techniques (^{14}C , optic stimulated luminescence, $^{36}\text{Cl}/\text{Cl}$)
- Reconstruction of paleoclimate and permafrost conditions of an extreme continental region close to Laurentide and Cordilleran ice sheets
- Characterization of glacial and interglacial climate and permafrost interactions, including periods of rapid climate change
- Reconstruction of paleoecology of an ice-age refugium using ancient organic matter characteristics and fossil bioindicators
- Studying the Beringia's eastern edge of the Yedoma domain



Field work in the Little Blanche Creek valley in summer 2023



Ice wedge sampling with chainsaw



Sampling of frozen sediment



Combined studies of ice wedges and frozen sediments

Field work in the Bear Creek valley in summer 2023

- Driven 20 to 100 km every day by car with a Ford 1-ton-truck F350.
- All ice and sediment samples are kept frozen.



Relativ small open cast mine in the Bear Creek valley



Permafrost wall exposed by water canons

Fossil bones of the late Pleistocene Mammoth Fauna were found in every outcrop

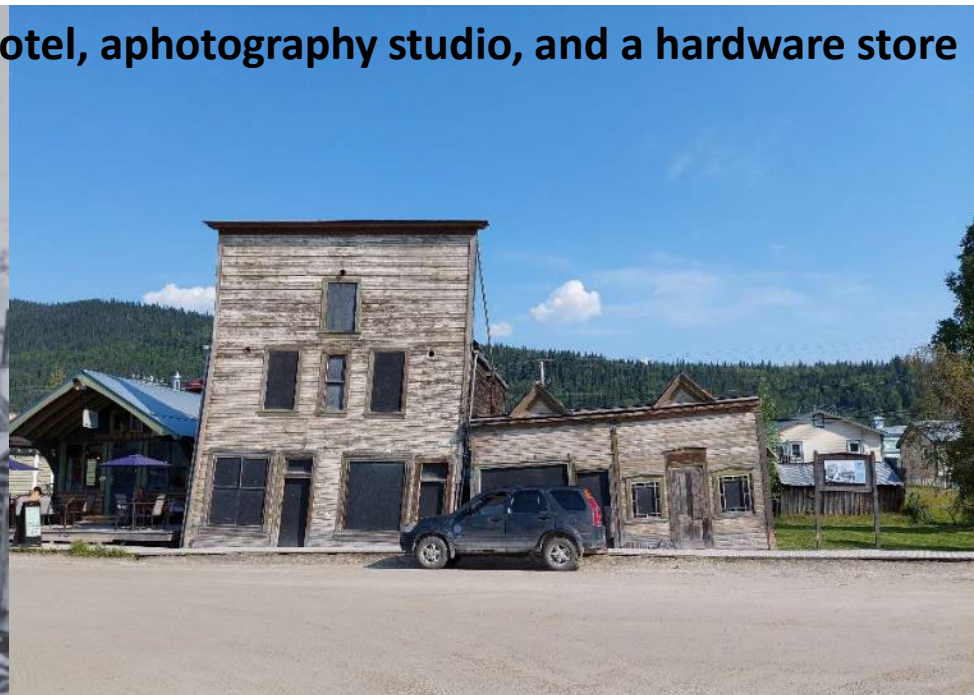
According to the literature woolly mammoth, horse, bison, American lion, mountain sheep, giant beaver, mastodon, muskox, caribou, moose, camel, brown bear, and saiga antelope were found in the placer mines of the Klondike Goldfields



Permafrost thawing in Dawson City



3rd Avenue Complex 1901 and 2023: a hotel, a photography studio, and a hardware store



**Landslide
(Moosehide
Slide) behind
Dawson City**



St. Andrew's Presbyterian Church



The accommodation in Dawson City



- Whitehouse Cabins - A room with a view overlooking the Yukon River!
- Very luxurious for a permafrost expedition

Results of the expedition and more

42 ice wedge blocks,
49 frozen biomarker samples,
51 frozen sediment samples,
7 luminescence samples,
8 microplastic samples,

50 ice content analyses,
profiles likely covering MIS 4 to MIS 1



Planned analyses:

- Geochronology (radiocarbon, optic stimulated luminescence, $^{36}\text{Cl}/\text{Cl}$),
- Sedimentology (grain size, magnetic susceptibility, carbonate, Hg, heavy minerals),
- Biogeochemistry (TC, TOC, TN, biomarkers)
- Hydrochemistry (pH, EC, dissolved ions, DOC),
- stable Isotopes ($\delta^{13}\text{C}$, $\delta^{15}\text{N}$, δD , $\delta^{18}\text{O}$),
- Paleoecology



Thank you!

